

IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA, *et al.*,)

)

Plaintiffs,)

)

v.)

Case No. 4:05-cv-00329-GKF-PJC

)

TYSON FOODS, INC., *et al.*,)

)

Defendants.)

DEFENDANTS' RESPONSE TO STATE OF OKLAHOMA'S
MOTION IN LIMINE TO PRECLUDE EXPERT TESTIMONY OF
DEFENDANTS' WITNESS TIMOTHY J. SULLIVAN, Ph.D.

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The undersigned Defendants respectfully request that the Court deny the State of Oklahoma's Motion in Limine to Preclude Expert Testimony of Defendants' Witness Timothy J. Sullivan, Ph.D (Dkt. No. 2071). Plaintiff State of Oklahoma (the "State") challenges the admissibility of expert opinions offered by Dr. Sullivan, stating that they are either not reliable or not relevant. However, the State's arguments are ineffective and do not provide a basis for this Court to exclude Dr. Sullivan's expert testimony. Therefore, the Court should deny the State's motion in limine.

LEGAL STANDARD

In determining whether to allow expert testimony, federal courts are bound by Federal Rule of Evidence 702, as well as *Daubert v. Merrell Dow Pharmaceuticals, Inc.* 509 U.S. 579, 587 (1993) and its progeny. Rule 702 sets forth specific criteria which the court must evaluate prior to the admission of expert testimony, providing as follows:

If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.

To determine whether an expert opinion is reliable, the court performs a two-step analysis involving both the relevance and the reliability of the testimony. *Investors I, L.P. v. Square D Co.*, 470 F.3d 985, 990 (10th Cir. 2006).

Relevance

Rule 702's requirement that the evidence or testimony "assist the trier of fact to understand the evidence or to determine a fact in issue" goes to the relevance of the testimony; "expert testimony which does not relate to any issue in the case is not relevant and, ergo, nonhelpful." *Daubert*, 509 U.S. at 591. The requirements that expert testimony proffered in a case must be specifically tied to the facts of the case and that such testimony must assist the jury

in resolving a factual dispute are also referred as to “fitness” and “helpfulness,” respectively. *Id.* Fitness can be difficult to determine, as scientific validity for one purpose is not necessarily scientific validity for another unrelated purpose. *Id.* A court may exclude scientifically reliable evidence and testimony where it is not directly relevant to the particular matter disputed at trial, and would not therefore “assist the trier of fact as required by Rule 702.” *United States v. Charley*, 189 F.3d 1251, 1267 (10th Cir. 1999).

Reliability

Daubert expanded on the guidance provided by Rule 702 and assigned a “gate keeping” role to trial judges, which requires the court to ensure that any and all expert testimony or evidence that is admitted is not only relevant, but also reliable. *Daubert*, 509 U.S. at 589. First, the court must determine whether the expert is qualified by “knowledge, skill, experience, training, or education” to render an opinion. *Id.* Although *Daubert* required that the subject of the expert’s testimony be “scientific knowledge,”¹ as a threshold by which to judge evidentiary reliability, the Court in *Kumho Tire v. Carmichael* held that Rule 702 makes no distinction between “scientific” knowledge and “technical” or “other specialized” knowledge, thus allowing these other types of expert knowledge to be used in testimony as well. *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 147 (1999).

It is clear that an expert must have expertise specifically related to the opinion testimony he intends to offer. In *Ralston v. Smith & Nephew Richards, Inc.*, the court held that an expert must stay “within the reasonable confines of his subject area.” 275 F.3d 965, 970 (10th Cir. 2001) (citing *Compton v. Subaru of America, Inc.*, 82 F.3d 1513, 1520 (10th Cir. 1996)). Relying on *Ralston*, this Court stated that “it should be borne in mind that ‘[t]he issue with

¹ Scientific knowledge was defined as a process by which theoretical explanations about the world are subject to further testing and refinement. *Daubert*, 509 U.S. at 590.

regard to expert testimony is not the qualifications of a witness in the abstract, but whether those qualifications provide a foundation for a witness to answer a specific question.” *In re Williams Securities Litigation*, 496 F.Supp.2d 1195, 1232 (N.D. Okla. 2007) (citing *Berry v. City of Detroit*, 25 F.3d 1342, 1351 (6th Cir. 1994), *cert. denied*, 513 U.S. 1111, 115 S.Ct. 902, 130 L.Ed.2d 786 (1995)). This Court further stated that an expert’s qualifications must be “specific to the matters he proposes to address as an expert.” *Id.*

The second step of the court’s reliability analysis is to decide whether the expert’s opinion testimony satisfies certain principles set forth in *Daubert. Investors*, 470 F.3d at 990 In determining whether a particular scientific theory is reliable, the court may consider several nondispositive factors: (1) whether the proffered theory can and has been tested; (2) whether the theory has been subject to peer review; (3) whether there is a known or potential rate of error and whether there are standards controlling the methodology’s operation; and (4) whether the theory has been accepted in the relevant scientific community. *Daubert*, 509 U.S. at 593-94. This list of factors was meant to be helpful, rather than definitive. *Kumho*, 526 U.S. at 151. *Kumho* further explains that the factors mentioned in *Daubert* cannot be ruled in or out for certain varieties of cases because too much depends on the circumstances of the particular case at issue. *Id.* at 150. The trial court retains broad discretion in assessing an expert’s reliability and making an ultimate determination of reliability. *Oklahoma v. Tyson Foods, et al.*, Case No. 08-5154, p. 16 (10th Cir. May 13, 2009). Therefore, a trial judge should consider those specific *Daubert* factors that are reasonable measures of the reliability of the expert’s testimony. *Kumho*, 526 U.S. at 151.

ARGUMENT

Plaintiff's challenge three aspects of Dr. Sullivan's expert report: (1) "the trophic state (degree of eutrophication) of Lake Tenkiller; (2) "whether or not phosphorus from land applied poultry waste runs off from IRW fields"; and (3) "comparisons of the level of indicator bacteria in IRW rivers and streams with other rivers and streams located in Oklahoma." Pl. State of Oklahoma's Motion in Limine to Preclude Expert Testimony of Defs.' Witness Timothy J. Sullivan, Ph.D. and Integrated Brief in Support Thereof ("State's Motion), p. 1. The State claims that Dr. Sullivan lacks experience in limnology, that he lacks reliable data or analysis to support his opinions concerning the runoff of phosphorus from land applied poultry waste and his opinions concerning the levels of indicator bacteria in Illinois River Watershed ("IRW") rivers as compared to other Oklahoma rivers, and that his comparison of the relative levels of bacteria in Oklahoma lacks relevance concerning the alleged danger presented by the indicator bacteria in the IRW rivers and the source of IRW bacteria. State's Motion, pp. 1-2. The State claims that these alleged deficiencies preclude the admission of Dr. Sullivan's expert opinion testimony at trial. *See generally, Id.*

A. Dr. Sullivan's References to the Trophic State of Lake Tenkiller do not Constitute Opinions

The State first argues that Dr. Sullivan has insufficient formal education in limnology and that his published work does not focus on lake/reservoir eutrophication or the trophic state of lakes or reservoirs. State's Motion, p. 2. Whether Dr. Sullivan is indeed a limnologist and whether his published work has focused on the trophic state of lakes or reservoirs is irrelevant as he does not issue any opinions regarding the trophic state of Lake Tenkiller. Rather, Dr. Sullivan's references to the trophic state of Lake Tenkiller are simply included in his report as the basis of his discussion of the chemical concentrations of water within Lake Tenkiller.

However, for purposes of responding fully to the State's motion to preclude Dr. Sullivan, Defendants offer the following evidence of Dr. Sullivan's extensive experience in limnology.

1. Dr. Sullivan Possesses Experience in the Field of Limnology

Dr. Sullivan does not apply the label limnologist to himself. Exh. 1, Deposition of Timothy J. Sullivan ("Sullivan Dep."), p. 157:9-10. He does not have a degree in limnology, which is one branch of environmental science. His masters degree is in biological sciences, and he obtained his Ph.D., also in biological sciences, through a multidisciplinary program of study with three areas of emphasis: ecology, zoology and environmental chemistry. See Exh. 2, Curriculum Vitae of Timothy J. Sullivan.²

To fully address the State's criticism, it is important to examine the scope of the field of limnology. Limnology involves the study of inland waters, including lakes, reservoirs, streams, and wetlands with respect to their physical, chemical, and biological environments. The study of limnology is highly interdisciplinary and, in the United States, tends to be scattered through a variety of university departments such as biology, environmental science, ecology, civil or environmental engineering, geology, and zoology, among others. A survey of sixty-nine universities found that only two of the surveyed universities had departments that included the name "limnology": one department of marine science and limnology, and one department of zoology and limnology. Commission on Geosciences, Environment, and Resources, Water Science and Technology Board, Committee on Inland Aquatic Ecosystems, *Freshwater Ecosystems: Revitalizing Educational Programs in Limnology* (1996) (available at http://books.nap.edu/openbook.php?record_id=5146&page=119) (accessed June 3, 2009). Dr.

² The State's "limnological experts," Dr. Eugene Welch and Dr. Dennis Cook, similarly do not have any degrees in limnology. Dr. Cooke's degrees are in biology and zoology. See Exh. 3, Curriculum Vitae of Dennis Cooke. Dr. Welch's degrees are in fisheries and in fisheries and wildlife. See Exh. 4, Curriculum Vitae of Eugene Welch.

Sullivan classifies himself as an environmental scientist, but he states that limnology is an “important part” of what he does. *See* Exh. 1, Sullivan Dep., p. 157: 9-10. In his deposition, Dr. Sullivan explained that he is a multidisciplinary environmental scientist, rather than being pigeonholed as a limnologist or some other specific type of scientist. *Id.*, p. 138:6-9. He stated that he has done a lot of limnological research. *Id.*, p. 138:11-13.

The State's assertion that Dr. Sullivan does not have expertise in limnology is simply incorrect. In truth, much of his published work is in disciplines that fall into the area of limnology. In his resume, Dr. Sullivan includes a list of book chapters and peer-reviewed scientific journal articles he has authored. *See* Exh. 5, Expert Report of Timothy J. Sullivan, Ph.D. ("Sullivan Report"), Appendix B, pp. 142-147. Of those fifty-five (55) book chapters and articles, thirty-six (36) focused largely on aspects of lake and/or stream water quality. *See* Exh. 6, Affidavit of Timothy J. Sullivan ("Sullivan Affidavit"), ¶ 2. These thirty-six (36) publications are most definitely limnological publications. Dr. Sullivan has also published two books that largely fall into the scientific field of limnology: Historical Changes in Surface Water Acid-Base Chemistry in Response to Acidic Deposition, a State of Science and Technology that was published by the U.S. National Acid Precipitation Assessment Program in 1990, and Aquatic Effects of Acidic Deposition, which was published in 2000 and which is commercially available. *See* Exh. 5, Sullivan Report, Appendix B, p. 141. Dr. Sullivan authored a section of the Water Encyclopedia in 2005, which related to lake and/or stream water quality, as well as many peer-reviewed and non peer-reviewed technical reports on lake and/or stream water quality. *Id.* These publications address a variety of aspects of water quality, including acid-base chemistry, nutrients, fecal indicator bacteria, suspended solids, and other variables, all areas which fall under the definition of limnology. Finally, Dr. Sullivan has co-authored numerous watershed

assessments, which cover aspects of water chemistry, water quantity, hydrology, fisheries, fecal indicator bacteria, stream channel morphology, and erosion, which are similarly all aspects of limnology. *Id.*, p. 10. Regardless of whether Dr. Sullivan is labeled a limnologist, he clearly has an extensive research and practical background in the study of inland waters which is sufficient to support any discussion of the state of waters in the IRW which is contained in his expert report.

2. Dr. Sullivan Does Not Opine on the Trophic State of Lake Tenkiller

Further, whether Dr. Sullivan should be classified as a limnologist is irrelevant. In asserting that Dr. Sullivan is not qualified in limnology and that he has not published on the trophic state of lakes or reservoirs, the State ignores the fact that Dr. Sullivan does not actually offer any opinions regarding the trophic state (degree of eutrophication) of Lake Tenkiller. In fact, Dr. Sullivan was not tasked with conducting any analyses to determine the trophic state of Lake Tenkiller, and he did not offer any opinions regarding the same. The portions of Dr. Sullivan's report to which the State objects simply cite to the work of the State's own experts, Dennis Cooke and Eugene Welch, regarding the trophic state of Lake Tenkiller as the basis for discussion contained in Dr. Sullivan's report. *See* Exh. 5, Sullivan Report, p. 91. Dr. Sullivan's Figure 15-3 illustrates phosphorus levels, which are one indication of the trophic state of a lake, for certain years. *See* Exh. 5, Sullivan Report, p. 91; Figure 15-3. Figure 15-3 is based on data analyses presented by Drs. Cooke and Welch in Figure 7 of their report submitted herein. *Id.*, p. 91. The purpose of this reference is not to quarrel with or offer his own opinion regarding the opinions contained in the Cooke and Welch report regarding such trophic state. Instead, Dr. Sullivan's reference to the work of Drs. Cooke and Welch simply serves as the basis for his

discussion of the concentrations of phosphorus and other chemicals present in the waters of the IRW.

In the legend for Figure 15-3, Dr. Sullivan indicated that the levels of total phosphorus at the Lake 1 site in Lake Tenkiller ("LK-01") for 2005, 2006, and 2007, place Lake Tenkiller in the mesotrophic class during those years. *See* Exh. 5, Sullivan Report, Figure 15-3. However, Dr. Sullivan did not make that classification himself; Figure 7 of the Cooke and Welch report contains such a classification. *See* Exh. 7, Expert Report of Dennis Cooke and Eugene Welch ("Cooke and Welch Report"), Figure 7; *see also* Exh. 8, Deposition of Eugene Welch ("Welch Dep."), p. 168:17-18 (stating that sites LK-01 and LK-02 are currently mesotrophic).³

Additional statements in Dr. Sullivan's report that relate to the trophic state of waters include his assertion that many streams around the United States are considered to be eutrophic. Exh. 5, Sullivan Report, p. 24 (citing Alexander, R.B. and R.A Smith, *Trends in the nutrient enrichment of U.S. rivers during the late 20th century and their relation to changes in probable stream trophic conditions*, *Limnol. Oceanogr.* 51(1, part 2), 639 – 654 (2006)). Dr. Sullivan also discusses evidence regarding whether or not phosphorus conditions in Lake Tenkiller have increased or decreased over time. *See i.* Again, these statements do not reflect an analysis of changes in trophic state; rather, they are simply part of Dr. Sullivan's examination of water quality chemistry data for phosphorus.

³ Figure 7 of the Cooke and Welch Report is a graph reflecting average seasonal total phosphorus at each of the Plaintiffs' four sampling sites at Lake Tenkiller in addition to what they term "lake average." *See* Exh. 7, Cooke and Welch Report, Figure 7. Dr. Cooke and Dr. Welch also show reference lines indicating boundaries between the various trophic classes at 10, 30, and 100 µg/L, and they cite work by Nurnberg in their figure note in support of those classifications. *Id.* For the three most recent years of study depicted by Dr. Cooke and Dr. Welch, 2005, 2006, and 2007, the total phosphorus concentrations at the lacustrine (lake-like) sampling sites LK-01 and LK-02, as well as the "lake average" concentration of total phosphorus, were between 10 and 30 µg/L. *Id.* That puts Lake Tenkiller in the mesotrophic class. *Id.* Additionally, they also label the 10 to 30 µg/L range as "mesotrophic" on their graph. *Id.*

Whether Dr. Sullivan possesses expertise related to the determination of trophic state is irrelevant as he offered no opinions on that topic. The purpose of his reference to the trophic state of Lake Tenkiller is actually to convey information about the phosphorus concentrations of Lake Tenkiller at different times and locations, an area of his expertise unchallenged by the State.

B. Dr. Sullivan Does Offer Supporting Data, Analyses, and Tests for his Opinions Regarding Phosphorus and Bacteria Runoff

The State argues that with respect to Dr. Sullivan's opinions regarding whether phosphorus runs off from the fields upon which it is applied, Dr. Sullivan admitted that his opinion is founded solely on his "general sense." State's Motion, p. 7. The State further asserts that Dr. Sullivan is not aware of research which quantifies the effectiveness of the phosphorus index in preventing or reducing phosphorus runoff. Again, this challenge mischaracterizes Dr. Sullivan's testimony and portrays a distorted view of the scope of the work Dr. Sullivan completed in this case.

In his deposition, Dr. Sullivan stated that "there are places in the Illinois River watershed where one would not expect that there would be appreciable movement of phosphorus from that area to another area or, in particular, to a nearby stream. That's probably the majority of the land area, but I've not conducted analyses to try to determine if it's the majority of the land area, but that would be my general sense . . ." Exh. 1, Sullivan Dep., p. 349:2-9. Dr. Sullivan did not make this statement in response to a question specifically regarding the basis for his opinions as to whether phosphorus and bacteria runs off from land. In fact, this quoted language does not relate to the basis for such an opinion at all; rather, with this statement, Dr. Sullivan was simply trying to convey the idea that certain land within the IRW is hydrologically active, thereby providing an increased likelihood of phosphorus transport to streams during rain storms

via overland flow, and that certain land within the IRW is not hydrologically active. *See* Exh., 5, Sullivan Report, pp. 135 – 136.⁴

When viewed in the proper context of surrounding deposition testimony, Dr. Sullivan's comment relates to the concept, expressed in his report, that Oklahoma's and Arkansas' existing poultry litter application regulations prohibit land application of poultry litter in areas that have a high likelihood of being hydrologically active, such as streamside areas, areas that flood, and land which is frozen. Exh. 5, Sullivan Report, p. 78; *see also* Exh. 1, Sullivan Dep., p. 346:24 – p. 347:13. By prohibiting land application of poultry litter on such areas through those regulations, it is the intent of Oklahoma and Arkansas to minimize or prevent phosphorus movement via overland flow from pasture land to stream.⁵ Just as Dr. Sullivan has conducted no studies to determine what percentage of the total IRW area each type of land occupies, neither have the State's experts. In reality, it is not Dr. Sullivan's responsibility to attempt to quantify these percentages, nor do the exact percentages have any relevance to his opinions. *See generally*, Exh. 5, Sullivan Report. What does matter is that regulations do exist which prohibit land application of poultry litter in areas expected to have a high probability of being

⁴ This concept is confirmed by Frank Coale, Ph.D. in his November 26, 2008 declaration. Dr. Coale offers the opinion that "surface runoff is not generated from every pasture field." Exh. 9, Declaration of Frank Coale ("Coale Declaration"), ¶ 5(h). Dr. Coale further states that "the site-specific physical characteristics of a particular field will determine the potential for surface runoff following a rainfall event." *Id.*

⁵ Dr. Coale echoes this sentiment, stating that "assessment of P losses must be site specific" and "must be able to identify 'critical source areas,'" which he and Dr. Sullivan both define as an area with high transport potential and high P source. *See* Exh. 9, Coale Declaration, ¶ 5(h), Figure 1; *see also* Exh. 5, Sullivan Report, Figure 11-2. Dr. Coale expounds upon this definition, stating that "[i]n order for P losses from an agricultural field to be of heightened ecological concern, the site must contain both a substantial source of P and active pathways through which the P may be transported to an adjacent body of water." Exh. 9, Coale Declaration, ¶ 5(e). The Oklahoma and Arkansas regulations prevent the creation of critical source areas by limiting the application of phosphorus to an area with high transport potential.

hydrologically active. The State has not identified any evidence showing that poultry litter is currently applied to such hydrologically active areas in the IRW, nor has the State identified any hydrologically active areas in the IRW. *See generally*, Exh. 5, Sullivan Report, p. 112.

Although neither Dr. Sullivan nor the State's experts conducted research or analysis in this action to determine the extent to which phosphorus, or any other constituent, does move from pasture to stream in the IRW, Dr. Sullivan has conducted such research with respect to fecal coliform bacteria elsewhere. Exh. 6, Sullivan Affidavit, ¶ 4. Dr. Sullivan published such research in the peer-reviewed and "grey" literature, which includes publications issued by government, academia, business and industry, but not controlled by commercial publishing interests. *Id.*, ¶ 3. Clearly, Dr. Sullivan has experience with the principles associated with runoff of phosphorus and bacteria from land-applied fields such that he is qualified to offer opinions relating to such runoff.

The State also claims that Dr. Sullivan is aware of no study or research quantifying the effectiveness of the Arkansas phosphorus index in reducing or eliminating phosphorus runoff. State's Motion, p. 7. This claim is simply without merit. Such approaches do constitute part of the existing federal and state guidelines and regulations for poultry litter management, the intent of which is to protect water quality.⁶ Widespread governmental acceptance of the concept of a

⁶ *See* Exh. 5, Sullivan Report, p. 112 (discussing the development of the phosphorus index by the U.S. Department of Agriculture and stating that "[t]o date, at least 47 states have adopted the P index approach by modifying the basic components to fit local conditions. This adoption of the P index concept by at least 47 states illustrates the consensus among scientists, industry, and policy makers in the United States that such an integrated approach is appropriate."); *see also* Exh. 9, Coale Declaration, ¶ 7(b) ("The established standard for site-specific evaluation of P loss potential is the "Phosphorus Index" (P Index), or similar site-specific evaluation tools known by various names in different jurisdictions. Nationwide, at least 47 states have developed P Indices by modifying a common structure of basic components to make it suitable for local conditions. Such widespread adoption of this indexing concept demonstrates the consensus among scientist,

phosphorus index reflects its effectiveness. Phosphorus indices and other related regulations and guidelines are designed to prevent or minimize phosphorus movement from field to stream. These approaches are based on sound scientific principles, which are well described in Dr. Sullivan's report. It is incumbent on the Plaintiffs in this case to show site-specific evidence that such approaches are not successful in the IRW; the burden does not rest upon the Defendants or their experts to show that the statutes and regulations adopted by Oklahoma and Arkansas are effective. Plaintiffs have not met this burden. Dr. Sullivan's testimony is that the approaches appear sound, that they are based on current scientific understanding, that they are supported by federal and state agencies, and that their function is to protect water quality. *See* Exh. 5, Sullivan Report, p. 102-107; 112. Plaintiffs have presented no data indicating that these guidelines and regulations are not having their intended effect.

The State's criticism of Dr. Sullivan's opinions regarding runoff of phosphorus and bacteria is misplaced. The deposition testimony which they cite in support of their criticism does not even relate to an opinion which Dr. Sullivan was tasked with issuing or which is included in his report. Dr. Sullivan does have prior experience with respect to the concepts associated with runoff of constituents of land-applied livestock manure, and his opinions in this case regarding such runoff are well-supported by his prior research. His opinions regarding the effectiveness of a phosphorus index are supported by the inclusion of such indices in multiple government regulations, both federal and state.

industry, and policy makers with regards to the validity of the P Index approach (Maguire et al., www.sera17.ext.vt.edu).").

C. Dr. Sullivan's Opinion Concerning the Bacterial Water Quality of Oklahoma Rivers is Reliable and Relevant as Sullivan's Use of Geometric Means is Proper

The State contends that Dr. Sullivan's analysis of water quality violations is based on a faulty application of the geometric mean method of calculation set forth in the Oklahoma Administrative Code. The State's criticism of Dr. Sullivan's calculation of the geometric means rests upon the fact that Dr. Sullivan calculated those means using sampling data collected over a seven-year period. State's Motion, p. 8. The State's criticism is unfounded, as it is based upon the assumption that Dr. Sullivan used his geometric means to assess water quality violations. In fact, Dr. Sullivan's geomean calculations were not used for this purpose; instead, they were used to analyze spatial patterns in water quality data. Additionally, while Dr. Sullivan did evaluate water quality violations, he relied upon calculations performed by the State of Oklahoma to do so.

1. Dr. Sullivan Used His Calculated Geometric Means Only for Purposes of Spatial Analysis of Fecal Indicator Bacteria

Dr. Sullivan did calculate a set of geomeans and did so based upon data collected over a seven year period. Exh. 5, Sullivan Report, p. 19. He used these geomean values not to determine whether Oklahoma's water quality standard for primary body contact recreation was violated, as is asserted by the State in its motion and by Dr. Teaf in ¶ 10 of his May 15, 2009 Declaration, but rather for purposes of evaluating non-regulatory spatial patterns in water quality data. *Id.*, p. 19-25. Dr. Sullivan evaluated spatial patterns in fecal indicator bacteria in order to assess:

- whether concentrations of fecal indicator in the IRW are unusually high, thereby constituting cause for alarm, as claimed by Plaintiffs;
- whether relatively high fecal indicator bacteria concentrations in Oklahoma waters correspond spatially with available information on poultry density within the state; and

- whether concentrations of fecal indicator bacteria in waters inside the IRW are more likely to exceed standard criteria than are concentrations found in waters located outside the IRW. *Id.*

Neither Oklahoma statutes nor the Oklahoma Administrative Code contains any requirement that a geomean to be used for this purpose must be calculated based upon samples collected within a thirty day period. In fact, it is common practice that such spatial analyses of water quality are based upon samples collected over widely varying periods of time, ranging from a few days or weeks to multiple decades. Exh. 6, Sullivan Affidavit, ¶¶ 5-6. It is clear that a spatial analysis of surface water quality, such as that conducted by Dr. Sullivan and reflected in Figures 2-6 through 2-13 and Figures 2-15 through 2-17 in his expert report, can be based on data collected over widely varying time periods ranging from one or a few seasons or years to multiple decades. Simply because the State of Oklahoma requires that data be collected over a period of not more than thirty days for purposes of evaluating compliance with water quality standards for primary body contact recreation, it does not follow that analysis of fecal indicator bacteria for other purposes, such as that conducted by Dr. Sullivan, must be similarly restricted. Dr. Sullivan's methods of calculating geomeans for purposes of spatial analysis are supported by reliable and widely accepted scientific methods. *See id.*

2. Dr. Sullivan Based His Evaluation of Water Quality Violations Upon Thirty-Day Geomeans Calculated by the State of Oklahoma

785 O.A.C. § 45-5-16 does indeed require that a geomean calculated for purposes of assessing water quality violations as they relate to the beneficial use of primary body contact recreation must be based upon at least five samples collected over a period of not more than thirty days. However, Dr. Sullivan used geomeans calculated by the State of Oklahoma itself in his assessments of water quality violations. Figure 2-4 in Dr. Sullivan's report addresses

regulatory compliance for primary body contact recreation, showing stream reaches that are 303(d) listed as water quality impaired for supporting the beneficial use of primary body contact recreation. *See* Exh. 5, Sullivan Report, Figure 2-4, p. 20. Figure 2-4 is based upon the State of Oklahoma's 303(d) list for 2006. *Id.*, Figure 2-4, p. 20. Figure 2-4 includes separate listings for each of the fecal indicator bacteria types applicable to the Oklahoma standards. *Id.* The analyses associated with Figure 2-4 are based upon a thirty-day geomean, as calculated by the State of Oklahoma. In addition to the information contained in Figure 2-4, Dr. Sullivan also discussed findings by ODEQ's Oklahoma Water Quality Assessment Integrated Report for 2004 and OWRB's Beneficial Use Monitoring Program (BUMP) Draft 2007 Stream Report, both of which relate to compliance of Oklahoma surface water with regulatory standards. Exh. 5, Sullivan Report, p. 19 (stating that only a small portion of streams in Oklahoma designated as having the beneficial use "primary body contact recreation," i.e., swimming, fully supported that beneficial use). This discussion is also based upon the State's determination of standards exceedences, which are calculated as 30-day geomeans. Therefore, for purposes of assessing water quality violations, Dr. Sullivan used only geomeans calculated by Oklahoma agencies that comply with the requirements of 785 O.A.C. § 45-5-16.

It is important to understand the link between the purpose for which geomeans are to be used and the applicable requirements for collection of underlying data. An evaluation of regulatory compliance with primary body contact standards in Oklahoma requires analysis of samples collected over a period of not more than 30 days; spatial assessment of water quality for purposes other than regulatory compliance do not typically have such a temporal restriction. Assertions by the State to the contrary are wrong. By stating that Dr. Sullivan has improperly calculated geomeans, when such geomeans were not calculated by Dr. Sullivan for any purpose

subject to regulation by the state of Oklahoma, the State misleads the Court as to the validity of Dr. Sullivan's methods.

D. Dr. Sullivan's Opinion Concerning the Bacterial Water Quality of Oklahoma Rivers is Relevant Because They Demonstrate There is Nothing Unusual Occurring in the IRW as Compared to the Rest of Oklahoma

The State claims that Dr. Sullivan's "overall concept of comparing the bacterial levels of IRW rivers with other Oklahoma rivers should be precluded because it is also irrelevant." State's Motion, p. 8. This is based upon Dr. Teaf's assertion that "simply because another river in Oklahoma is contaminated by bacteria it does not mean that the rivers of the IRW have not been contaminated by the land application of poultry waste as well." *Id.* Dr. Teaf further stated that Dr. Sullivan made "no specific effort to ascribe bacterial sources to individual water bodies in the state." *Id.*, p. 9. The State makes these assertions without providing any factual basis for its arguments, and such arguments are simply without merit.

In reality, Dr. Sullivan's analysis and comparison of bacterial water quality in waters located inside the IRW and waters located outside the IRW is relevant because it shows that fecal indicator bacterial concentrations:

- are not unusually high in IRW streams as compared to streams elsewhere in Oklahoma; and
- are not higher in portions of Oklahoma that have a substantial poultry industry, as compared with portions of Oklahoma that do not have a substantial poultry industry.

See Exh. 5, Sullivan Report, pp. 19 and 85. This analysis and comparison are important to the resolution of this case because they relate to the validity of the State's claims of damage to waters of the IRW. They also demonstrate that poultry litter may not be as significant a contributor of fecal indicator bacteria to the waters of the IRW as the State's experts claim and that the State's claim of an imminent and substantial threat in the IRW is invalid.

While Dr. Teaf and the State claim that Dr. Sullivan did not detail the bacterial sources contributing to individual water bodies, Dr. Sullivan's report does discuss in great detail the fact that a multitude of potential sources of fecal indicator bacteria, and phosphorus, do exist with respect to streams both in the IRW and elsewhere. Exh. 5, Sullivan Report, p. 25-50. Specifically, Dr. Sullivan states that "[w]ater quality data in the IRW reflect a variety of sources associated with a mix of land uses." *Id.*, p. 25. He identifies waste water treatment plant effluent, livestock, septic systems, erosion, and runoff from urban and other developed areas as potential sources of phosphorus to stream water in the IRW. *Id.* With respect to fecal indicator bacteria, the most important sources are livestock, septic systems, urban runoff, accidental sewage discharge and other sewage bypasses, river recreationists, and wildlife. *Id.*⁷ Dr. Sullivan also explains that the significance of any potential source depends on the particular circumstances in the watershed at issue. *See, e.g., Id.*, p. 68 – 71 (opining that concentrations of P and fecal indicator bacteria in stream water are strongly dependent on water flow and stream order); p. 15 (stating that "[i]t is well known and widely recognized that P loss potential is dependent on an array of site condition and management factors, as well as loading factors"). Dr. Sullivan demonstrates that the analyses of the State's consultants fail to differentiate among potential sources of bacteria and phosphorus in the IRW, even though such potential sources were identified by Shanon Haraughty in her Comprehensive Basin Management Plan. Exh. 5, Sullivan Report, p. 25-50; Exh. 1, Sullivan Dep., p. 413:4-20. Further, the State's experts provide no scientifically defensible evidence in support of their claim that the land application of

⁷ Dr. Sullivan found that higher concentrations of phosphorus and fecal indicator bacteria "tended to be associated with urban areas and wastewater treatment plant outflow locations." Exh. 1, Sullivan Dep., p. 317:25 – 318:9; *see also id.*, p. 446:15 – 448:6.

poultry litter is the dominant, or even an appreciable, source of fecal indicator bacteria or phosphorus, as compared to other potential sources. Exh. 5, Sullivan Report, p. 114-117.

The fact that Dr. Sullivan does not ascribe particular sources of fecal indicator bacteria to concentrations of such bacteria in streams throughout Oklahoma does not foreclose the relevance of his opinions. Dr. Sullivan's criticism of the opinions offered by the State's expert witnesses regarding concentrations and sources of phosphorus and bacteria is that the State's experts ignore or unreasonably downplay the significance of most potential significant sources of fecal indicator bacteria, phosphorus, and other constituents, choosing instead to focus solely, without any demonstrated factual or scientific basis, on the land application of poultry litter.⁸ Dr. Sullivan's opinions demonstrate not only that there are other potential sources, but also that neither fecal indicator bacteria nor phosphorus concentrations are higher inside the IRW as compared with outside the IRW and that such concentrations are not spatially correlated with poultry farming activities within the IRW or throughout Oklahoma. Rather, based on the State's own data collected for this case, within the IRW, concentrations of these constituents are highest immediately downstream of wastewater treatment facilities and urban land use.

CONCLUSION

For the foregoing reasons, the Court should not grant the State of Oklahoma's Motion in Limine to Preclude Expert Testimony of Defendants' Witness Timothy J. Sullivan, Ph.D.

⁸ Dr. Sullivan offered these opinions during the Preliminary Injunction Hearing and his testimony was part of the Court's findings in denying Plaintiffs' Motion for Preliminary Injunction. See Exh. 10, Reporter's Transcript of Proceedings, March 11, 2008, Preliminary Injunction Hearing, Volume VIII, p. 2056 - 2143.

Respectfully submitted,

BY: /s/ Michael R. Bond

Michael R. Bond, *appearing pro hac vice*
Erin Thompson, *appearing pro hac vice*
Dustin R. Darst, *appearing pro hac vice*
KUTAK ROCK LLP
234 East Millsap Road, Suite 400
Fayetteville, Arkansas 72703-4099
(479) 973-4200 Telephone
(479) 973-0007 Facsimile

-and-

Robert W. George, OBA #18562
Bryan Burns, *appearing pro hac vice*
TYSON FOODS, INC.
2210 West Oaklawn Drive
Springdale, Arkansas 72762
(479) 290-4067 Telephone
(479) 290-7967 Facsimile

-and-

Patrick M. Ryan, OBA # 7864
Paula M. Buchwald, OBA # 20464
RYAN, WHALEY & COLDIRON, P.C.
119 North Robinson, Suite 900
Oklahoma City, Oklahoma 73102
(405) 239-6040 Telephone
(405) 239-6766 Facsimile

-and-

Jay T. Jorgensen, *appearing pro hac vice*
Thomas C. Green, *appearing pro hac vice*
Mark D. Hopson, *appearing pro hac vice*
Gordon D. Todd, *appearing pro hac vice*
SIDLEY AUSTIN LLP
1501 K Street, N.W.
Washington, D.C. 20005-1401
(202) 736-8000 Telephone
(202) 736-8711 Facsimile

Attorneys for Defendants Tyson Foods,
Inc., Tyson Chicken, Inc., Tyson Poultry,
Inc., and Cobb-Vantress, Inc.

BY: /s/James M. Graves

(SIGNED BY FILING ATTORNEY WITH
PERMISSION)

Woodson W. Bassett III
Gary V. Weeks
James M. Graves
K.C. Dupps Tucker
BASSETT LAW FIRM
P.O. Box 3618
Fayetteville, AR 72702-3618
Telephone: (479) 521-9996
Facsimile: (479) 521-9600

-and-

Randall E. Rose, OBA #7753
George W. Owens
OWENS LAW FIRM, P.C.
234 W. 13th Street
Tulsa, OK 74119
Telephone: (918) 587-0021
Facsimile: (918) 587-6111

Attorneys for George's, Inc. and George's
Farms, Inc.

BY: /s/ A. Scott McDaniel

(SIGNED BY FILING ATTORNEY WITH
PERMISSION)

A. Scott McDaniel, OBA #16460
Nicole M. Longwell, OBA #18771
Philip D. Hixon, OBA #19121
MCDANIEL, HIXON, LONGWELL
& ACORD, PLLC
320 South Boston Ave., Ste. 700
Tulsa, OK 74103
Telephone: (918) 382-9200
Facsimile: (918) 382-9282

-and-

Sherry P. Bartley
MITCHELL, WILLIAMS, SELIG,

GATES & WOODYARD, PLLC
425 W. Capitol Avenue, Suite 1800
Little Rock, AR 72201
Telephone: (501) 688-8800
Facsimile: (501) 688-8807

Attorneys for Peterson Farms, Inc.

BY: /s/ John R. Elrod

(SIGNED BY FILING ATTORNEY WITH
PERMISSION)

John R. Elrod
Vicki Bronson, OBA #20574
P. Joshua Wisley
CONNER & WINTERS, L.L.P.
211 East Dickson Street
Fayetteville, AR 72701
Telephone: (479) 582-5711
Facsimile: (479) 587-1426

-and-

Bruce W. Freeman
D. Richard Funk
CONNER & WINTERS, L.L.P.
4000 One Williams Center
Tulsa, OK 74172
Telephone: (918) 586-5711
Facsimile: (918) 586-8553

Attorneys for Simmons Foods, Inc.

BY: /s/ Robert P. Redemann

(SIGNED BY FILING ATTORNEY WITH
PERMISSION)

Robert P. Redemann, OBA #7454
PERRINE, MCGIVERN, REDEMANN,
REID, BERRY & TAYLOR, P.L.L.C.
Post Office Box 1710
Tulsa, OK 74101-1710
Telephone: (918) 382-1400
Facsimile: (918) 382-1499

-and-

Robert E. Sanders
Stephen Williams
YOUNG WILLIAMS P.A.
Post Office Box 23059
Jackson, MS 39225-3059
Telephone: (601) 948-6100
Facsimile: (601) 355-6136

Attorneys for Cal-Maine Farms, Inc. and Cal-
Maine Foods, Inc.

BY: /s/ John H. Tucker

(SIGNED BY FILING ATTORNEY
WITH PERMISSION)

John H. Tucker, OBA #9110
Theresa Noble Hill, OBA #19119
RHODES, HIERONYMUS, JONES, TUCKER &
GABLE, PLLC
P.O. Box 21100
Tulsa, Oklahoma 74121-1100
Telephone: (918) 582-1173
Facsimile: (918) 592-3390

-and-

Delmar R. Ehrich
Bruce Jones
Krisann C. Kleibacker Lee
Todd P. Walker
Melissa C. Collins
FAEGRE & BENSON LLP
2200 Wells Fargo Center
90 South Seventh Street
Minneapolis, Minnesota 55402
Telephone: (612) 766-7000
Facsimile: (612) 766-1600

-and-

Dara D. Mann
MCKENNA, LONG & ADLRIDGE, LLP
303 Peachtree Street, NE, Suite 5300
Atlanta, GA 30308
Telephone: (404) 527-8579
Facsimile: (404) 527-8849

Attorneys for Cargill, Inc. and Cargill
Turkey Production, LLC

CERTIFICATE OF SERVICE

I certify that on the 5th day of June 2009, I electronically transmitted the attached document to the Clerk of Court using the ECF System for filing and transmittal of a Notice of Electronic Filing to the following ECF registrants:

W. A. Drew Edmondson, Attorney General
Kelly Hunter Burch, Assistant Attorney General

drew_edmondson@oag.state.ok.us
kelly_burch@oag.state.ok.us

Douglas Allen Wilson
Melvin David Riggs
Richard T. Garren
Sharon K. Weaver
Robert Allen Nance
Dorothy Sharon Gentry
Joseph P. Lennart
David P. Page
RIGGS ABNEY NEAL TURPEN ORBISON & LEWIS

doug_wilson@riggsabney.com
driggs@riggsabney.com
rgarren@riggsabney.com
sweaver@riggsabney.com
rnance@riggsabney.com
sgentry@riggsabney.com
jlennart@riggsabney.com
dpage@riggsabney.com

Louis W. Bullock
Robert M. Blakemore
BULLOCK BULLOCK & BLAKEMORE, PLLC

lbullock@bullock-blakemore.com
bblakemore@bullock-blakemore.com

Frederick C. Baker
Lee M. Heath
William H. Narwold
Elizabeth C. Ward
Elizabeth Claire Xidis
Ingrid L. Moll
Jonathan D. Orent
Michael G. Rousseau
Fidelma L. Fitzpatrick
MOTLEY RICE, LLC
COUNSEL FOR PLAINTIFFS

fbaker@motleyrice.com
lheath@motleyrice.com
bnarwold@motleyrice.com
lward@motleyrice.com
cxidis@motleyrice.com
imoll@motleyrice.com
jorent@motleyrice.com
mrousseau@motleyrice.com
ffitzpatrick@motleyrice.com

A. Scott McDaniel

smcdaniel@mhla-law.com

Nicole Longwell
Philip D. Hixon
Craig A. Mirkes
MCDANIEL HIXON LONGWELL & ACORD, PLLC

nlongwell@mhla-law.com
phixon@mhla-law.com
cmirkes@mhla-law.com

Sherry P. Bartley
MITCHELL, WILLIAMS, SELIG, GATES & WOODYARD, PLLC
COUNSEL FOR PETERSON FARMS, INC.

sbartley@mws gw.com

Robert P. Redemann
David C. Senger
PERRINE, MCGIVERN, REDEMANN, REID, BERRY & TAYLOR, PLLC

rredemann@pmrlaw.net
dsenger@pmrlaw.net

Robert E. Sanders
E. Stephen Williams
YOUNG WILLIAMS P.A.
COUNSEL FOR CAL-MAINE FOODS, INC. AND CAL-MAINE FARMS, INC.

rsanders@youngwilliams.com
steve.williams@youngwilliams.com

George W. Owens
Randall E. Rose
THE OWENS LAW FIRM, P.C.

gwo@owenslawfirm pc.com
rer@owenslawfirm pc.com

James M. Graves
Gary V. Weeks
Woody Bassett
K.C. Dupps Tucker
BASSETT LAW FIRM
COUNSEL FOR GEORGE'S INC. AND GEORGE'S FARMS, INC.

jgraves@bassettlawfirm.com
gweeks@bassettlawfirm.com
wbassett@bassettlawfirm.com
kctucker@bassettlawfirm.com

John R. Elrod
Vicki Bronson
Bruce W. Freeman
D. Richard Funk
P. Joshua Wisley
CONNER & WINTERS, PLLC
COUNSEL FOR SIMMONS FOODS, INC.

jelrod@cwlaw.com
vbronson@cwlaw.com
bfreeman@cwlaw.com
dfunk@cwlaw.com
jwisley@cwlaw.com

John H. Tucker
Colin H. Tucker
Theresa Noble Hill
Leslie J. Southerland
RHODES, HIERONYMUS, JONES, TUCKER & GABLE

jtucker@rhodesokla.com
chtucker@rhodesokla.com
thill@rhodesokla.com
ljsoutherland@rhodesokla.com

Terry W. West
THE WEST LAW FIRM

terry@thewestlawfirm.com

Delmar R. Ehrich
Bruce Jones
Krisann C. Kleibacker Lee
Todd P. Walker
Melissa C. Collins

dehrich@faegre.com
bjones@faegre.com
kklee@faegre.com
twalker@faegre.com
mcollins@faegre.com

FAEGRE & BENSON LLP

Dara D. Mann

dmann@mckennalong.com

MCKENNA, LONG & ADLRIDGE, LLP

COUNSEL FOR CARGILL, INC. AND CARGILL TURKEY PRODUCTION, LLC

I also hereby certify that I served the attached documents by United States Postal Service, proper postage paid, on the following who are not registered participants of the ECF System:

Mr. J.D. Strong
Secretary of the Environment
State of Oklahoma
3800 North Classen
Oklahoma City, OK 73118

/s/ Michael R. Bond

Michael R. Bond